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as the animals which we are considering are not attached, but are nomadic in nature. There is nothing to prevent a comparison between the nomadic life of deep water and that of the Arctic, even if the facies of the abyssal zone is different from that of any oceanic fauna of the globe. While the difficulties in the investigation of the animals of the polar regions are such that much remains yet unknown in relation to the surface life of these latitudes, the similarity of that of the Bay of Fundy to it, if such a likeness really exists, renders this study comparatively easy. It becomes imperative, then, to know accurately the facies of this fauna if one would use this knowledge in comparisons with deep-sea faunæ.

CEREBROLOGY AND THE POSSIBLE SOMETHING IN PHRENOLOGY.

BY S. V. CLEVINGER, M.D.

TEN years ago, in the *American Journal of Nervous and Mental Disease*, I reviewed the history of brain studies, from Erasistratus to Ferrier, and described the convolutions and fissures with their equivalent names as used by English, German, French and Italian investigators. Microscopic details had at that time added immensely to our knowledge of the structure of this important organ, but since then pathological and physiological science has corrected many of the errors prevalent and improved our understanding of the localization of function.

When it was established that arm, leg, tongue, ear and eye centres were distributed about the brain cortex, beneath alleged bumps of conjugality, appetite for music, theology and onions, phrenology was discouraged except among its more ignorant devotees. At the conclusion of a popular lecture on the anatomy and physiology of the brain I was assailed by an itinerant phrenologist who did not relish his dollar-a-head prospects being jeopardized by the spread of my heresies. He offered to stake money on the infallibility of his "science" in a public demonstration, and when told that phrenology had been written up in a form available for criticism and

found to be defective, he warmed to the conclusion that he could lick any one who opposed phrenology with such "ipsy dixys."

Gall and Spurzheim are always cited by phrenologists as the founders of their system. While this is true, and it is also undoubted that they were in advance of the early part of this century in brain anatomy and philosophical guess work of brain functions, it is forgotten that but few anatomists of note have sustained the theories that have been piled upon the fairly well done work of a time when brain study was infantile. The ignorance of those who practice phrenology as an art, their illogicality, impudence and rapacity for fees, the fact that phrenology stands isolated from all the sciences, having nothing to do with physiology, chemistry, microscopy or pathology, as cerebrology has; its frequent defiance of exact knowledge which negatives the pretensions of bumpology, —all relegate phrenological claims to an equality with those of spiritualism, Christian science, jugglery and the multitude of penny-catching devices of an age of never-failing crops of knaves and fools. There is nothing like a good knowledge of physiology to destroy charlatanism and the superstition upon which it fattens.

But alchemy gave us some chemical facts, and astrology was mixed up with a few astronomical truths. Psychical research societies are trying to examine prestidigitation as one would study the mechanism of a watch through its key-hole, and it seems to me that patient study can be applied profitably to an examination of moribund old phrenology.

The tendency was extreme to locate pin-head points on the cranium that would reveal such things as whether one preferred coffee to tea; but, starting with the admission that there is a little truth in phrenology, in a general way, we are also confronted with the fact that, no matter how it is done, there has been some pretty shrewd guessing at character by even ignorant phrenologists. Their physiognomy studies are incomparably inferior to those of Darwin, or even those of the windy Lavater. Every one is an unconscious physiognomist without having analyzed expression; phrenologists make use of this common ability in estimating character. But this does not include their entire method, as they often hit off traits more happily than mere expression would enable them to do.

First of all let us glance at what is really known about heads

and their contents, and then see how much of phrenology can be adjusted thereto.

Prognathism and acuteness of Camper's angle are well-known indications of less intelligence. Apes also have less skull capacity with larger and more numerous ridges for muscle attachment.

The European has a characteristic medium (mesocephalic), rounder, oval or elliptical head, with no portion too prominent or flat, presenting more symmetry of contour, with oval face and full, expanded, elevated forehead. Want of symmetry, if marked, attends mental defect, but it has occurred in highly gifted men such as the French anatomist Bichat. No two heads are exactly alike any more than are two faces. The proportions existing between the front, middle and back parts of the head are of some value; departures from a width of eight and length of ten (mesocephalism), measured from one auricular aperture over the head to the other, and nose root over the head to the nucha, determine whether the skull shall be considered long, dolichocephalic, or broad, brachycephalic.

The front expanse is associated with a possible reasoning power, the back part with animality, but as this is necessary to force of character, a well-balanced head would be one that had a fair size of both parts. As the frontal bone is elevated the parietal must be raised to meet it. The artist Haydon, by cutting off this parietal raise, showed that the head was reduced from an intellectual to an animal appearance. Scaphocephalism, or a boat-shaped depression of the summit, occurs from defective parietal bone formation.

The Kalmucks incline to brachycephalism, while the negro is dolichocephalic, with prognathous jaw, large temporal and auricular muscles and low foreheads; the Esquimaux are tectocephalic (rafter-headed), with flat, pyramidal or lozenge-shaped faces, due to excessive zygoma projection, and narrow foreheads.

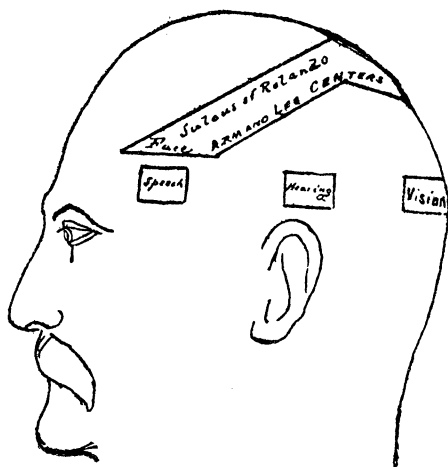
Carpenter notes that want, squalor and ignorance diminish the cranial and increase the facial size.

With increase of intelligence there is a larger brain mass in proportion to the muscular size, and also to the size of the spinal cord and peripheral nerves. I claim priority¹ in adopting the sulcus of

¹ Sulcus of Rolando and Intelligence. Written Feb., 1880. *Journal of Nervous and Mental Disease*, April, 1880.

Rolando as a means of estimating grades of intelligence in animals by the relative *masses* of brain parts it separated. Meynert¹ had, unknown to me, nearly simultaneously, stated that the angle at which the Rolandic departed from the Sylvian fissure was a measure, but in this he is in error, for that angle is *not* constant for species, while the relative proportions of fore and rear brain divided by the Rolandic sulcus maintain a just ratio to grades of intelligence, and the left sulcus summit should be farther back in the normal brain than the one upon the right side. I also claimed that the cerebellum was covered by the cerebrum in proportion as the frontal lobe developed and crowded the occipital portion backward. The forehead by this pressure is correspondingly expanded and lifted.

In the scale of higher intelligence the connecting commissures of the brain are more numerous, and the cortical gray matter is encroached upon by more cells and fibres. Convolutions are not necessarily more numerous, except where the cranium is relatively small and the soft brain tissue by rapid growth folds in to accommodate itself to the want of corresponding skull growth.



In accord with the results of earlier electrical experiments upon the bared brains of anthropoid apes, dogs and other animals, are the effects of disease limited to special parts of the brain of man,

¹ Archiv für Psychiatrie, vii.

more recently and thoroughly studied. We now know that there are centres in the brain of man for the speech faculty above the temple, and thence backward and upward to the upper back part of the head are arm and leg centres; auditory mental impressions being registered in the brain above the upper ear tip; a centre for visual function being in the occipital end of the cerebrum. The frontal brain is known to contribute to intellectual processes, for its injury degrades the character. This approximately sketches what has become positively known, and the illustration further assists the comprehension of these facts. The touch sense centres are distributed over the brain coincidentally, with motor centres for the same parts, *i.e.*, arm motor and sensory areas are in the same part of the brain.

Spaces intervening between the areas may readily be conceived to be filled with fibrils and cells that interrelate these and other functions complexly, the frontal portion compound complexly.

Sir Charles Bell remarked that "we ought to define the hand as belonging exclusively to man." Upon the increased dexterity in the use of fingers in the arts and sciences, which dexterity, in turn, develops brain centres, depends, largely, increased intelligence. Manipulation and vocal training enlarge the "symbolic field" of the brain (the speech, arm and leg centres before mentioned), situated along the sulcus of Rolando. Man is distinctively the symbolic animal, and whether these symbols are written, spoken or gesticulated, they serve purposes of intelligent intercourse, and upon this fact is based man's supremacy over other animals, and his higher faculties are superimposed thereupon.

When the portions of the brain allotted to control of body extremities are diseased, the dependent loss of function follows, but not necessarily involving mental loss; for example, if the injury is at the summit of the sulcus of Rolando, upon one side of the brain, the body is paralyzed upon the opposite side. The "blank spaces" between these centre areas afford debatable ground, for often injury in such parts has been followed by no discovered consequence. My opinion is that the effects have not been looked for in the proper direction; for, while destruction limited to these blank parts does not occasion loss of observable function (the arms, legs, speech may be unaffected), there will be found an attendant lowering of the

mentality in some or several directions, if thorough tests be made. What has been grouped under change of character should be sifted to ascertain what constitutes the change. If we grant, as we must, that all these function areas, ascertained to be such, are related, connected, by multitudes of strands and cells in the most complex manner over and across the blank spaces, then lesion of those spaces must interfere with the connections, the mental associations possible before cannot now be made. Occasionally "word deafness" or "word blindness" occurs, peculiar inability to connect words heard or read with any memory of their import, and, as could be expected, this impairment occurs when the lower parietal or "angular gyrus" region is the seat of the disease. While this consequence of injury to this part has been long known, I believe this to be the first announcement of the reason for it, and I will predict that the additional offices of this "blank area" will be established as noted below. "Arcuate" connecting fibrils enmesh the brain surface, uniting faculties intricately, in a manner obviously dependent upon the education and other circumstances of the individual. These fibrils and their generating cells may pile up in certain parts and be defective in others; the musician will have more connections between the auditory and motor centres, and the painter between the optic and motor, than others. One whose impulses or springs of action are well subordinated to what he has learned through optic, auditory or other senses, will have greater strands of connections between the sensory and motor brain parts to regulate his deeds than the impulsive or heedless person.

These blank spaces become what might be styled inhibitory regions, in that they restrain acts; they can also more properly be called impulse areas, because they regulate and prompt actions. As they correlate the sense and motor centres, they are also memory areas, as is evident when injury causes words to convey no meaning to the mind. Now, if what we see, feel and hear govern our actions, he who profits best by what he has been taught, or upon whom such teaching makes the best impression, will, *à priori*, have the most abundant supply of arcuate fibrils in this parietal region; such restraint or guidance unavoidably causes acts to be less impulsive, more subordinated to the interests of the individual. If those needs are considered to be best conserved by subservience to others

their approval will tend to regulate acts, a form of cautious deference dominates the person; if a wider, higher and better form of cautiousness, based upon what one considers his highest interests, his higher expediency ideals, whether with reference to this or another world, then the person is said to be conscientious. At this stage of analysis of what these inhibitory or impulse connections involved, I was astounded by recalling that phrenologists group "conscientiousness, approbateness and cautiousness" in the identical place under discussion. The process of arriving at this discovery was by first recognizing inhibition to be but cautious control, and I have long held the idea that conscientiousness was but a higher caution.¹ Startled by noting that phrenologists place them next one another, as they assert, empirically, they having found these eminences to be prominent in persons who were thus scrupulous or guarded, I next observed that "approbateness" is placed behind, but adjoining "caution and conscientiousness." This narration should acquit me of special pleading. Disposed unfavorably, as I was and am, against phrenology, as in the main a pseudo-science, my aim has been to unsparingly criticize it.

This group of alleged bumps in the position the phrenologists assign it is a remarkable coincidence, if it prove to be no more.

I prefer the designation *Impulse and Memory region* until more scientific men than phrenologists agree upon the separation of the area into the divisions, "cautiousness, conscientiousness and approbateness," which cannot be done until we ascertain whether phrenologists lied, were mistaken, or were right in this particular.

"Firmness, Self-esteem, and Continuity" are placed by them over the tonsure or earliest bald spot, beneath which in the brain is the summit of the Rolandic sulcus, injury to which invariably causes paralysis of the opposite side. We can concede that an abundance of arm and leg centres in this region would indicate the possession of self-reliance, nor would it be far-fetched to interpret such control as firmness, scoring another for phrenology; an excess of this might be construed into self-esteem, and if the motor area (as in fact it does sometimes) extend farther occipitally, then this brain centre increase of cells and fibrils serving for better innervation of arms, legs and other parts, might be allowed to constitute

¹ Comparative Physiology and Psychology. A. C. McClurg & Co., 1884.

"continuity" in enabling more prolonged effort. Coincidences that may be justified by a real relationship. *Quien sabe?*

Below and toward the front is "Hope." If thought has its main seat in the frontal region, a prolongation of fibrils thence to control acts with a definite expectation in view, anticipation based upon reason, might justify some such bump as this, and in about that location. "Ideality" seems better placed, farther forward, for a similar reason, and not open to the objection of being located over arm and leg centres, as is "Hope," although arcuate fibrils having many destinations may overlie any part of the brain.

"Benevolence" is placed near or over the anterior fontanelle. As this trait is the outgrowth of sympathy, an acute feeling for others depending upon a thoughtful correlation of past experiences or impressions inherited or acquired, so there *may* be such a swelling in that vicinity.

"Constructiveness" is over the third frontal convolution root, which, on the left side, is the demonstrated seat of language, so the bump is mislocated. A rounding out of the side head above and forward of this could indicate the possession of such a faculty, because it depends upon ingenuity, mechanical ability, etc., a brain and mental breadth.

"Eventuality, Comparison, Causality, Individuality," in the frontal apices, apparently appropriately enough, for cerebral reasons.

The claim that "Amativeness" resides in the cerebellum has been sufficiently disproved by the experiments recorded in Carpenter's *Physiology*, where the cerebrum, and not the cerebellum, decreased in size with sexual loss. Furthermore, the cerebellum has no relation whatever to the posterior protrusion of the skull. A large muscular development is an indication of animality, which may be offset by intellectual balancing. Large trapezius and sterno-cleido-mastoid muscles would have a correspondingly large occipital ridge, and it is over this that the phrenologists locate "Amativeness."

The animal propensities, "Combativeness, Secretiveness, Destructiveness, Alimentiveness and Acquisitiveness" are suggestively gathered over the temporal and auricular muscles, as these muscles are large in rapacious animals. Without admitting the spe-

cial divisions, these animal traits undoubtedly could accompany extra prominence of these muscles in the place assigned to these faculties by the phrenologists, while there is not a cerebral or cranial warrant for the location, palpably when beneath this muscular swelling the skull is often depressed to afford it attachment. "Alimentiveness" is appropriately placed over the temporo-maxillary articulation; a great eater works this vicinity more, and thus may increase its size.

The superciliary ridge may be enlarged by serviceable and associated habit in shielding the eye, frowning while trying to perceive better, and thus indicate perceptive acuteness, but the subdivisions into size, color, etc., require demonstration, as extremely doubtful.

"Form" is said to be shown by width between the eyes. I know good artists who have not this width, and execrable ones who have it. Language does not produce œdema of the lower eye-lids; the faculty is remotely and surely situated under the alleged "Constructiveness."

It would not be profitable to discuss the other bumps, as they seem rather absurd.

We thus alight upon three main character indications, due to brain, skull or muscle prominences, which the phrenologists erroneously call cranial, and regard the brain as the cause of the skull elevations.

Thus, for cerebral reasons, there seems to be a plausibility in the location of

Firmness, Self esteem, Continuity. Possibly justified by the underlying motor centres for the arm and leg. Cerebral control of the body.

Cautiousness, Conscientiousness, Approbativeness. Inhibitory faculties situated over spaces between rearward brain centres.

Benevolence, Hope, Ideality, Constructiveness. Inhibitory or impulse faculties between motor and intellect centres.

Causality, Comparison, Eventuality, Individuality. Intellectual faculties of the fore brain, internuncial fibrils relating other brain parts, correlating impulse areas.

For muscular and cranial reasons there is justification for the grouping of

Combativeness, Destructiveness, Secretiveness, Acquisitiveness, Alimentiveness. Animal traits that can be grouped under Ferocity, accompanied with large-sized temporal and auricular muscles.

Amativeness. Animality, with large neck muscles, occipital ridge and mastoid process.

Perceptives. In proportion to size of eye-brow ridge.

The remaining half of the phrenological faculties appear wholly or nearly wholly, unjustified.

Divested of the less plausible alleged faculties, the remaining ones, when subjected to the crucial test of Herbert Spencer's classifications of the feelings and cognitions, stand the scrutiny quite well, for the presentative feelings can be assigned to the cortical centres for sight, etc., and the impulse areas will include from behind forward the presentative-representative or emotions, the representative as "sublimity," and re-representative such as acquisitiveness, which might tempt us to take the latter out of the temporal muscle and allow it the position assigned by the phrenologists as cerebral. The cognitions similarly classified end in the highest of all, being placed in the apex of the frontal lobe, the re-representative cognitions, aggregations of representations, the appreciation of the general relations of things.

There is something beside generalizations in phrenology hidden beneath a load of trash. In shoveling this away scientific men are apt to jeer the labor; they can be as mulish as the most ignorant in refusing to see what they do not want to know; they are human, as witness the reluctance with which the majority accepted Darwinism, though emanating from a reputable source.

It should not be forgotten that phrenology was founded by good anatomists, and that scientists turned against it because charlatans built error upon it; but quacks have taught us a few things worth knowing.